

IN THE CLAIMS:

- 1 1. (Previously Amended) A system for replay of a backup memory in a storage sys-
2 tem having a file system for managing transfer of data to and from an attached disk array,
3 the system comprising:
4 a log in the backup memory containing the storage system transaction entries ac-
5 cumulated after a consistency point at which time results of the storage system transac-
6 tion entries are committed to the disk array;
7 an initiator process that establishes a swarm of messages with respect to the stor-
8 age system transaction entries and delivers the swarm to the file system; and
9 a disk information-retrieval process in the file system that is carried out on the
10 swarm of messages in parallel.
- 1 2. (Original) The system as set forth in claim 1 wherein each of the messages of the
2 swarm is identified by a transaction block including a pointer to one of the transaction
3 request entries in the log, respectively, and a state that indicates whether each of the mes-
4 sages is one of (a) newly transferred to the file system, (b) subject to completion of a
5 LOAD phase thereon by the disk information-retrieval process, (c) subject to completion
6 of a MODIFY phase thereon by a MODIFY process of the file system or (d) incapable of
7 being subject to the LOAD phase until a prerequisite event occurs.
- 1 3. (Original) The system as set forth in claim 2 wherein the prerequisite event is com-
2 pletion of the LOAD phase and a MODIFY phase with respect to another of the mes-
3 sages.
- 1 4. (Original) The system as set forth in claim 3 wherein the initiator process is adapted
2 to retransfer each of the messages incapable of being subject to a load phase until the pre-

3 requisite event occurs to the file system for completion of the LOAD phase after the pre-
4 requisite event occurs, respectively.

1 5. (Original) The system as set forth in claim 4 wherein the initiator is adapted to estab-
2 lish a skip state with respect to skipped messages for which a portion of the disk array
3 associated therewith is unavailable, the skip state thereby omitting the skipped messages
4 from the swarm.

1 6. (Original) The system as set forth in claim 4 wherein the file system includes a panic
2 state adapted to alert an operator if a first message received from the initiator in the
3 swarm is a message incapable of being subject to a load phase until a prerequisite event
4 occurs.

1 7. (Original) The system as set forth in claim 4 wherein the file system includes a panic
2 state adapted to alert an operator if a message retransferred by the initiator process is a
3 message incapable of being subject to a load phase until a prerequisite event occurs.

1 8. (Original) The system as set forth in claim 1 wherein the backup memory comprises
2 a non-volatile random access memory (NVRAM).

1 9. (Original) The system as set forth in claim 1 wherein the storage system comprises a
2 network storage appliance.

1 10. (Original) A method for replay of a backup memory in a storage system having a file
2 system for managing transfer of data to and from an attached disk array, the method
3 comprising:

4 accumulating, in a log in the backup memory, storage system transaction request
5 entries after a consistency point at which time results of the transaction request entries are
6 committed to the disk array;

7 establishing a swarm of messages with respect to the transaction request entries
8 and delivering the swarm to the file system; and
9 performing a disk information-retrieval process of the file system on the swarm of
10 messages in parallel.

1 11. (Original) The method as set forth in claim 10 further comprising establishing, for
2 each of the messages of the swarm, a transaction block including a pointer to one of the
3 transaction request entries in the log, respectively, and a state that indicates whether each
4 of the messages is one of (a) newly transferred to the file system, (b) subject to comple-
5 tion of a LOAD phase thereon by the disk information-retrieval process, (c) subject to
6 completion of a MODIFY phase thereon by a MODIFY process of the file system or (d)
7 incapable of being subject to the LOAD phase until a prerequisite event occurs.

1 12. (Original) The method as set forth in claim 11 wherein the prerequisite event is com-
2 pletion of the LOAD phase and a MODIFY phase with respect to another of the mes-
3 sages.

1 13. (Original) The method as set forth in claim 12 further comprising retransferring each
2 of the messages incapable of being subject to a load phase until the prerequisite event oc-
3 curs to the file system for completion of the LOAD phase after the prerequisite event oc-
4 curs, respectively.

1 14. (Original) The method as set forth in claim 10 wherein the storage system comprises
2 a network storage appliance.

1 15. (Original) A computer-readable medium including program instructions executing on
2 a computer for parallelized replay of a backup memory in a storage system having a file
3 system for managing transfer of data to and from an attached disk array, the program in-
4 structions performing the steps of:

5 accumulating, in a log in the backup memory, storage system transaction request
6 entries after a consistency point at which results of the transaction request entries are
7 committed to the disk array;

8 establishing a swarm of messages with respect to the transaction request entries
9 and delivering the swarm to the file system; and

10 performing a disk information-retrieval process of the file system on the swarm of
11 messages in parallel.

1 16. (Original) The computer-readable medium as set forth in claim 15 further comprising
2 establishing, for each of the messages of the swarm, a transaction block including a
3 pointer to one of the transaction request entries in the log, respectively, in the log and a
4 state that indicates whether each of the messages is one of (a) newly transferred to the file
5 system, (b) subject to completion of the LOAD phase thereon by the disk information-
6 retrieval process, (c) subject to completion of a MODIFY phase thereon by a MODIFY
7 process of the file system or (d) incapable of being subject to the LOAD phase until a
8 prerequisite event occurs.

1 17. (Original) The computer-readable medium as set forth in claim 16 wherein the pre-
2 requisite event is completion of the LOAD phase and a MODIFY phase with respect to
3 another of the messages.

1 18. (Original) The computer-readable medium as set forth in claim 17 further comprising
2 retransferring each of the messages incapable of being subject to a load phase until the
3 prerequisite event occurs to the file system for completion of the LOAD phase after the
4 prerequisite event occurs, respectively.

1 19. (Original) The computer-readable medium as set forth in claim 15 wherein the stor-
2 age system comprises a network storage appliance.

Please add New Claims 20 *et seq.*

1 20. (New) An apparatus for replay of a backup memory in a storage system having a file
2 system for managing transfer of data to and from an attached disk array, comprising:
3 a processor to determine a consistency point in time, said apparatus containing at
4 least one transaction entry accumulated after the consistency point, where before the con-
5 sistency point the transaction entries are committed to the disk array;
6 a plurality of messages, each message of said plurality of messages being related
7 to a transaction entry of said transaction entries accumulated after the consistency point,
8 said plurality of messages being referred to as a swarm of messages;
9 an initiator process to deliver the swarm of messages to the file system; and
10 a disk information-retrieval process that processes the swarm of messages in par-
11 allel to reestablish the storage system transactions after the consistency point.

1 21. (New) The apparatus as set forth in claim 20, further comprising:
2 each of the messages of the swarm is identified by a transaction block including a
3 pointer to one of the transaction request entries

1 22. (New) The apparatus as set for in claim 20, further comprising:
2 a state that indicates whether each of the messages is one of
3 (a) newly transferred to the file system,
4 (b) subject to completion of a LOAD phase thereon by the disk informa-
5 tion-retrieval process,
6 (c) subject to completion of a MODIFY phase thereon by a MODIFY pro-
7 cess of the file system, or
8 (d) incapable of being subject to the LOAD phase until a prerequisite
9 event occurs.

1 23. (New) The apparatus as set forth in claim 22, further comprising:
2 the prerequisite event is completion of the LOAD phase and a MODIFY phase
3 with respect to another of the messages.

1 24. (New) The apparatus as set forth in claim 23, further comprising:
2 the initiator process is adapted to retransfer each of the messages incapable of
3 being subject to a load phase until the prerequisite event occurs to the file system for
4 completion of the LOAD phase after the prerequisite event occurs, respectively.

1 25. (New) The apparatus as set forth in claim 20, further comprising:
2 the initiator is adapted to establish a skip state with respect to skipped messages
3 for which a portion of the disk array associated therewith is unavailable, the skip state
4 thereby omitting the skipped messages from the swarm.

1 26. (New) A method for replay of a backup memory in a storage system having a file
2 system for managing transfer of data to and from an attached disk array, the method
3 comprising:
4 accumulating a transaction request entry after a consistency point, said consis-
5 tency point is a time before which results of the transaction request entries are committed
6 to the disk array;
7 establishing a plurality of messages with respect to the transaction request entries,
8 said plurality of messages being referred to as a swarm of messages and delivering the
9 swarm to the file system; and
10 executing a disk information-retrieval process on the swarm of messages in par-
11 allel to reestablish the storage system transaction entries after the consistency point, the
12 messages of the swarm of messages being executed in parallel.

- 1 27. (New) The method as set forth in claim 26, further comprising:
2 establishing, for each of the messages of the swarm, a transaction block including
3 a pointer to one of the transaction request entries in the log.
- 1 28. (New) The method as set forth in claim 28, further comprising:
2 establishing a state that indicates whether each of the messages is one of
3 (a) newly transferred to the file system,
4 (b) subject to completion of a LOAD phase thereon by the disk informa-
5 tion-retrieval process,
6 (c) subject to completion of a MODIFY phase thereon by a MODIFY pro-
7 cess of the file system, or
8 (d) incapable of being subject to the LOAD phase until a prerequisite
9 event occurs.
- 1 29. (New) The method as set forth in claim 28, further comprising:
2 using as the prerequisite event completion of the LOAD phase and a MODIFY
3 phase with respect to another of the messages.
- 1 30. (New) The method as set forth in claim 29, further comprising:
2 retransferring each of the messages incapable of being subject to a load phase
3 until the prerequisite event occurs to the file system for completion of the LOAD phase
4 after the prerequisite event occurs.
- 1 31. (New) An apparatus for replay of a backup memory in a storage system having a file
2 system for managing transfer of data to and from an attached disk array, comprising:
3 means for accumulating, a transaction request entry after a consistency point, said
4 consistency point is a time before which results of the transaction request entries are
5 committed to the disk array;

6 means for establishing a plurality of messages with respect to the transaction re-
7 quest entries, said plurality of messages being referred to as a swarm of messages and
8 delivering the swarm to the file system; and

9 means for processing a disk information-retrieval process of the file system on the
10 swarm of messages in parallel to reestablish the storage system transaction entries after
11 the consistency point, the messages of the swarm of messages being executed in parallel.

1 32. (New) The apparatus as set forth in claim 31, further comprising:

2 means for establishing, for each of the messages of the swarm, a transaction block
3 including a pointer to one of the transaction request entries in the log.

1 33. (New) The apparatus as set forth in claim 32, further comprising:

2 means for establishing a state that indicates whether each of the messages is one
3 of

4 (a) newly transferred to the file system,

5 (b) subject to completion of a LOAD phase thereon by the disk informa-
6 tion-retrieval process,

7 (c) subject to completion of a MODIFY phase thereon by a MODIFY pro-
8 cess of the file system, or

9 (d) incapable of being subject to the LOAD phase until a prerequisite
10 event occurs.

1 34. (New) The apparatus as set forth in claim 33, further comprising:

2 means for using as the prerequisite event completion of the LOAD phase and a
3 MODIFY phase with respect to another of the messages.

- 1 35. (New) The apparatus as set forth in claim 34, further comprising:
2 means for retransferring each of the messages incapable of being subject to a load
3 phase until the prerequisite event occurs to the file system for completion of the LOAD
4 phase after the prerequisite event occurs.
- 1 36. (New) A computer readable media, comprising:
2 said computer readable media having instructions written thereon for execution on
3 a processor for the practice of the method of claim 10 or claim 26.
- 1 37. (New) Electromagnetic signals propagating on a computer network, comprising:
2 said electromagnetic signals carrying instructions for execution on a processor for
3 the practice of the method of claim 10 and 26.